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Chesapeake Bay Program
A Watershed Partnership

Backgrounder

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Since 1987, Chesapeake Bay Program partners have worked together to reduce the amount of nutrients flowing into the Bay and its rivers. High nutrient levels threaten the delicate balance of the Bay ecosystem by causing the rapid growth of unhealthy algae and prohibiting light from reaching underwater grasses critical to the health of the Bay's fish and shellfish.

On June 28, 2000, the Chesapeake Executive Council signed *Chesapeake 2000* – a new and far-reaching agreement that now guides Maryland, Pennsylvania, Virginia, the District of Columbia, the Chesapeake Bay Commission, and the U.S. Environmental Protection Agency in their combined efforts to restore and protect the Chesapeake Bay.

As part of that agreement, Bay Program partners agreed to work with the headwaters states of Delaware, New York and West Virginia to set new, aggressive nutrient and sediment reduction goals that will provide the water quality necessary for the Bay's plants and animals to thrive.

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Setting Nutrient and Sediment Reduction Goals for the Chesapeake Bay Watershed

New Nutrient Reduction Goals for Nitrogen and Phosphorus

On March 21, 2003, regional Bay restoration leaders agreed to steep cuts in the amount of nutrients flowing into the Bay and its rivers. The new goals commit the six Bay watershed states and the District of Columbia to reduce nutrient pollution by more than twice as much as was accomplished since coordinated Bay restoration efforts began nearly twenty years ago.

The new nutrient reduction goals, or allocations, call for Bay watershed states to reduce the amount of nitrogen from the current 285 million pounds to no more than 175 million pounds per year, and phosphorus from 19.1 million pounds to no more than 12.8 million pounds per year. When coordinated nutrient reduction efforts began in 1985, 338 million pounds of nitrogen and 27.1 million pounds of phosphorus entered the Bay annually.

When achieved, the new allocations will reduce annual nitrogen loads by 110 million pounds and phosphorus by 6.3 million pounds from 2000 levels and will provide the water quality necessary for the Bay's plants and animals to thrive.

For the First Time - A Baywide Sediment Reduction Goal

On April 15, 2003, regional Bay restoration leaders for the first time agreed to reduce Baywide sediment loads to provide water clarity necessary for underwater grasses to thrive. Bay states and the District of Columbia agreed to reduce land-based sediment runoff entering the Bay and its rivers from the current 5.04 million tons per year to no more than 4.15 million tons per year.

Throughout the next year, Bay Program partners will supplement land-based sediment reduction goals by focusing on nearshore sediment problems – such as shoreline erosion and the resuspension of shallow water sediments – that directly impact underwater grasses. Shoreline-based sediment reduction goals will be developed as part of each state's local tributary strategy process and work to reduce problems in areas most critical to improving underwater grass beds.

To drive aggressive sediment reductions, Bay Program partners also agreed to increase the existing bay grass restoration goal from 114,000 to 185,000 acres baywide by 2010. Scientists believe increasing bay grass coverage beyond today's 85,000 acres will result in dramatic improvements throughout the entire Bay ecosystem.

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Using Computer Models to Determine Allocations

To determine optimal nutrient and sediment allocations, Bay watershed partners developed several simulations for analysis by the Chesapeake Bay Watershed and Water Quality models. Each simulation, or scenario, allows Bay scientists to predict changes within the Bay ecosystem due to proposed management actions taking place throughout the Bay's 64,000-square-mile watershed.

Information is entered into the Watershed Model, which details likely results of proposed management actions. These actions range from improving wastewater treatment technology to reducing fertilizer or manure application on agricultural lands to implementing sound land use programs to planting streamside forest buffers.

Next, these results are run through the Bay Water Quality Model, which makes more than a trillion calculations and provides Bay scientists with a visualization of future Bay and river water quality conditions resulting from each scenario. Throughout the development of the new Bay water quality criteria, more than 70 Water Quality Model runs were conducted, each taking more than a week to complete.

At the agreed to allocation, the model predicts that we will see a Bay similar to that in the 1950s. Proposed water quality standards will be met in 96% of the Bay at all times, and the remaining 4% would fall shy of fully meeting the proposed standards for only four months a year.

Allocating Nutrient Reduction Goals to Each State in the Bay's Nine Major Basins

Once scientists arrived at baywide reduction goals, restoration leaders developed several approaches to allocate pollution reduction responsibilities to each state in the watershed. While the primary focus of the new nutrient and sediment reduction goals is to provide the water quality necessary for the Bay's plants and animals to thrive, the equitable distribution of nutrient reduction responsibilities was important to Bay watershed partners as well.

The Bay watershed was first divided into nine major river basins. Each basin was then subdivided by state boundaries resulting in 20 distinct state-specific basins. For example, the entire Susquehanna River basin was broken down into three state-specific basins belonging to New York, Pennsylvania and Maryland.

Then the effectiveness of implementing nutrient pollution controls in each of these zones was compared, and the 20 zones were separated into three groups. The primary group was targeted for the highest reductions, as nutrient reductions in these areas would result in the greatest environmental benefit for the Bay.

Many important factors were part of the final allocations equation, including pollution prevention strategies already implemented by each state, proximity to sensitive areas of the Bay (such as recovering SAV beds and oyster reefs), the overall effectiveness of proposed reductions and each state's relative contribution to water quality impairments.

The following pages detail nutrient and sediment allocations developed through this cooperative process. Bay Program partners will use the new goals to develop and hone plans to encourage residents, farmers, local governments, wastewater treatment plant operators and community watershed organizations to reduce the amount of nutrients and sediments flowing into local waterways.

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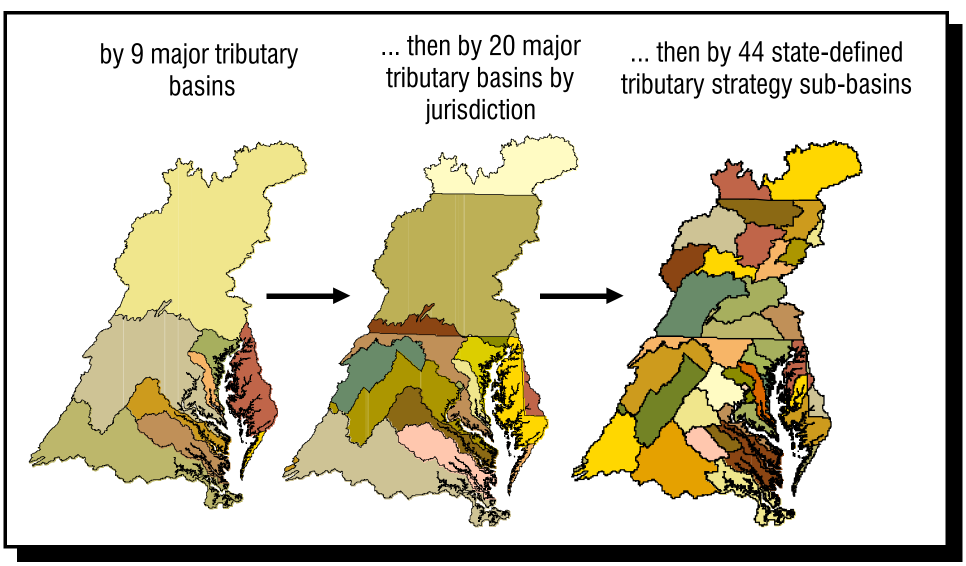

New nutrient and sediment goals were first allocated to the Bay watershed's nine major basins and then subdivided to state-specific zones within those basins.

This approach allows Bay Program partners to target pollution reduction efforts to have the greatest impact on the quality of local waters and the Bay.

Over the next year, these areas will be subdivided again into 44 state-defined tributary strategy basins that will allow the states to work with local residents to determine the best way to prevent pollution from reaching the Bay and its rivers.

Chesapeake Bay Watershed Nutrient and Sediment Reduction Goals by Basin

Basin/Jurisdiction	Nitrogen Allocation (million pounds/year)	Phosphorus Allocation (million pounds/year)	Land-based Sediment Allocation (million tons/year)
Susquehanna			
Pennsylvania	67.58	1.90	.793
New York	12.58	0.59	.131
Maryland	0.83	0.03	.037
Total	80.99	2.52	.962
Eastern Shore of Maryland			
Maryland	10.89	0.81	.116
Delaware	2.88	0.30	.042
Pennsylvania	0.27	0.03	.004
Virginia	0.06	0.01	.001
Total	14.10	1.14	.163
Western Shore of Maryland			
Maryland	11.27	0.84	.100
Pennsylvania	0.02	0.00	.001
Total	11.29	0.84	.100
Patuxent			
Maryland	2.46	0.21	.095
Potomac			
Virginia	12.84	1.40	.617
Maryland	11.81	1.04	.364
West Virginia	4.71	0.36	.311
Pennsylvania	4.02	0.33	.197
District of Columbia	2.40	0.34	.006
Total	35.78	3.48	1.494
Rappahannock			
Virginia	5.24	0.62	.288
York			
Virginia	5.70	0.48	.103
James			
Virginia	26.40	3.41	.925
West Virginia	0.03	0.01	.010
Total	26.43	3.42	.935
Eastern Shore of Virginia			
Virginia	1.16	0.08	.008
Basinwide Subtotal	183	12.8	4.15
Clear Skies Reduction	-8		
Basinwide Total	175	12.8	4.15

* Some figures may not add up due to rounding

Chesapeake Bay Watershed Nutrient and Sediment Reduction Goals by State

Jurisdiction/Basin	Nitrogen Allocation (million pounds/year)	Phosphorus Allocation (million pounds/year)	Land-based Sediment Allocation (million tons/year)
Delaware			
Eastern Shore of MD	2.88	0.30	.042
DE Total	2.88	0.30	.042
District of Columbia			
Potomac	2.40	0.34	.006
DC Total	2.40	0.34	.006
Maryland			
Susquehanna	0.83	0.03	.037
Patuxent	2.46	0.21	.095
Potomac	11.81	1.04	.364
Western Shore	11.27	0.84	.100
Eastern Shore of MD	10.89	0.81	.116
MD Total	37.25	2.92	.712
New York			
Susquehanna	12.58	0.59	.131
NY Total	12.58	0.59	.131
Pennsylvania			
Susquehanna	67.58	1.90	.793
Potomac	4.02	0.33	.197
Western Shore	0.02	0.00	.001
Eastern Shore of MD	0.27	0.03	.004
PA Total	71.90	2.26	.995
Virginia			
Potomac	12.84	1.40	.617
Rappahannock	5.24	0.62	.288
York	5.70	0.48	.103
James	26.40	3.41	.925
Eastern Shore of MD	0.06	0.01	.001
Eastern Shore of VA	1.16	0.08	.008
VA Total	51.40	6.00	1.941
West Virginia			
Potomac	4.71	0.36	.311
James	0.03	0.01	.010
WV Total	4.75	0.37	.320
Basinwide Subtotal	183	12.80	4.15
Clear Skies Reduction	-8		
Basinwide Total	175	12.80	4.15

* Some figures may not add up due to rounding

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Chesapeake Bay Water Quality Protection and Restoration: An Innovative Approach

On June 28, 2000, the Chesapeake Executive Council signed *Chesapeake 2000* – a new and far-reaching agreement that now guides Maryland, Pennsylvania, Virginia, the District of Columbia, the Chesapeake Bay Commission and the U.S. Environmental Protection Agency in their combined efforts to restore and protect the Chesapeake Bay.

As part of that agreement, Bay Program partners agreed to work with the headwaters states of Delaware, New York and West Virginia to develop a new process for setting and achieving nutrients and sediment load reductions necessary to restore Bay water quality.

This process requires Bay Program partners to continue to build on previous nitrogen and phosphorus reduction goals, but instead of measuring improvement against broad percentage reduction goals, they must now establish and meet specific water quality standards based on the needs of the Bay's plants and animals.

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This new approach to improving Bay water quality incorporates elements traditionally found in the regulatory TMDL process, such as criteria, standards and load allocations, but has been developed and applied through a cooperative process involving six states, the District of Columbia, local governments and involved citizens. For the first time, Delaware, New York and West Virginia are formally partnering with EPA, Maryland, Pennsylvania, Virginia and the District to improve water quality throughout the Bay watershed.

Regulations Guiding Bay Water Quality

In 1998, the Chesapeake Bay and many of its tidal tributaries were added to the list of impaired waters, thus requiring the development of a TMDL to comply with the Clean Water Act. A TMDL is the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. It is calculated by totaling all the allowable loads of a single pollutant entering a body of water from all contributing point and nonpoint sources.

TMDLs also allocate the amount each pollutant source is allowed to release while still attaining water quality standards set by individual states and approved by EPA. These allocations are then regulated through enforcement of permit limits, principally directed at point source dischargers and the implementation of Best Management Practices (BMPs) for nonpoint sources.

Chesapeake Bay Impairments and TMDLs

The Chesapeake Bay's main water quality impairment is its low dissolved oxygen (DO). Current state water quality standards require 5 mg/L of dissolved oxygen throughout all of the Bay's waters – from deeper waters near the Bay's mouth to the shallows at the head of the Bay. Even though the 5 mg/L standard is baywide, scientists believe natural conditions dictate that in some sections of the Bay, such as the deep channel, Bay waters cannot achieve the current 5 mg/L standard. Additionally, scientists believe other areas, such as prime spawning areas, require higher levels of dissolved oxygen to sustain life. In addition to dissolved oxygen, other Chesapeake Bay impairments include reduced light conditions and too much algae.

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The Transition to New Water Quality Criteria

Because conditions throughout the Bay differ based on depth, salinity and season, a uniform Baywide standard does not take into account the varying needs of different plants and animals. As a result, current state water quality standards need to be revised to account for the natural variability in conditions found throughout the Bay. The Bay criteria the Chesapeake Bay Program has proposed differ from one region of the Bay to another, as determined by the plants and animals residing in that area. The Bay Program also proposes that the new standards also remain constant for similar habitats across all jurisdictions.

The new water quality standards the will be based on three criteria: dissolved oxygen, water clarity and chlorophyll *a*. All plants and animals in the Bay need oxygen to live. Water clarity is a measure of the amount of sunlight that penetrates the Bay's waters and reaches the leaves of underwater bay grasses. All plants, even those underwater, need light to live and produce oxygen for other Bay creatures. Chlorophyll *a* is used to measure the abundance and variety of microscopic plants or algae that form the base of the food chain. Excessive nutrients can stimulate nuisance algae blooms resulting in reduced water clarity, reduced amount of fish food and depleted oxygen levels in deeper water.

A “Parallel” TMDL

In a standard regulatory approach, TMDLs would need to be completed for the Chesapeake Bay and its tributaries by 2011. TMDLs require a very specific implementation plan, with “reasonable assurances” (e.g. enforceable permit limits) that load allocations will be achieved. Under the TMDL framework, new, innovative or untried solutions are not likely to be approved as part of the implementation plan.

However, due to the success of the Bay Program partnership over the past two decades, Bay Program partners have agreed to develop and carry out a cooperative approach to remove water quality impairments by 2010. This cooperative approach will allow the states and the District of Columbia more flexibility on how to reduce pollutant loads. Maryland, Pennsylvania, Virginia, New York, Delaware, West Virginia and the District of Columbia are jointly developing the new water quality criteria, designated uses and cap load allocations needed to restore Bay water quality.

The cooperative process for removing the Bay from the impaired waters list includes load allocations to sources — point, nonpoint and atmospheric — just as a TMDL would. The states and the District of Columbia determined those allocations which are based on local tidal water quality as well as meeting the new Bay criteria. Each tributary basin has been given a load allocation based on each river's effect on the Bay's water quality.

In order to coordinate the regulatory TMDL framework with the Bay Program's cooperative, consensus-based approach, this process will incorporate local tributary regulatory TMDLs within the larger, basinwide cooperative framework.

Like TMDLs, the states and the District will have to describe a plan for the implementation of load allocations. However, unlike traditional TMDLs, the Bay Program process will allow innovative, new methods to be tried as part of the implementation and will involve significant local stakeholder involvement through the tributary strategy process.

Restoring the Chesapeake Bay: How We Get There

Over the next several years, Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia and the District of Columbia will continue their joint effort to improve water quality for the plants and animals living in the Chesapeake Bay and its tributaries.

Working with the U.S. Environmental Protection Agency, this seven-jurisdiction cooperative partnership will continue to work together to improve water quality through an innovative process that uses three simple, yet encompassing, criteria to monitor the health of the Bay's complex ecosystem and living resources — dissolved oxygen, chlorophyll *a* and water clarity.

This paper outlines the critical steps in this new process.

Water Quality Criteria for the Chesapeake Bay

Prior water quality criteria applied to the Chesapeake Bay were based on the assumption that all areas in the Bay were identical and did not take into account the natural variability found in the Bay's waters. Newly proposed water quality criteria – dissolved oxygen, chlorophyll *a* and water clarity – vary based on the needs of a healthy ecosystem. By analyzing the relationship between these three criteria, scientists are able to understand and monitor the more complex processes of the Bay ecosystem. Design and implementation of tributary strategies to meet these new, more appropriate criteria will enable the states and the District of Columbia to remove the Bay and its tidal tributaries from the impaired waters list.

Designated Uses and the Bay

A "designated use" refers to a water body's primary function – such as fishing or swimming – and takes into account the use of the water body for public water supply, the protection of fish, shellfish and wildlife, as well as its recreational, agricultural, industrial and navigational purposes. The suitability of the water body for these uses is also examined based on the physical, chemical and biological characteristics of the water body, its geographic setting and scenic qualities, and economic considerations.

To better position the states and the District to adopt new water quality standards that relate to the needs of the Bay's living resources, the Bay Program has developed and recommended five new refined designated uses for the Chesapeake Bay derived from different types of habitat. The five habitats – shallow water, open water, deep water, deep channel, and migratory and spawning areas – allow the water quality standards to be matched with the plants and animals that are adapted to life in those different areas, rather than on a single baywide standard.

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Water Quality Standards & Water Quality Criteria

Standards combine water quality criteria and designated uses to produce a target numeric value that, if achieved, will maintain healthy water quality. Together, the states and the District must achieve the standards needed for a thriving ecosystem if the Chesapeake Bay is to be removed from the list of impaired waters.

Cap Load Allocations & Implementation

Cap loads are the maximum amounts of pollutants allowed to flow into a waterbody and still ensure achievement of the water quality standards.

Bay Program partners used the Chesapeake Bay Watershed and Water Quality Models, along with monitoring data, to help determine these cap loads for nitrogen, phosphorus and sediment. These models are computer representations that simulate the real world, interpreting various levels of actions (management scenarios) to reduce different amounts of pollutant loads. These scenarios were run through the models to determine how to achieve baywide attainment of the water quality criteria.

The models, along with other information, were used to allocate cap loads to the nine major tributary basins in the watershed, and, then to twenty state-specific sub-basins. Each state and the District bear a proportional burden for achieving and maintaining the assigned cap based on their pollutant loadings and effects on different tributaries.

The Role of Tributary Strategies

Tributary strategies are the blueprint for improving Bay water quality by outlining the types and amount of reductions needed in a particular river basin. Each tributary strategy will be based on meeting the assigned cap load allocations. Strategies will outline the pollution reductions actions required to achieve the cap load allocations.

Development of tributary strategies has traditionally been a very public process with the direct participation of local governments and a wide variety of other interested stakeholders. In creating the strategies, the states and District of Columbia will explore and evaluate a wide variety of point and nonpoint source control measures. They will then draft a strategy using the most effective reduction options to achieve the cap load allocations.

Permits & Improving Water Quality

The 1972 Clean Water Act prohibits point source pollutants from being discharged into a waterbody without a National Pollutant Discharge Elimination System (NPDES) permit. The permit limits what can be discharged, requires monitoring and reporting, and ensures that the discharge is not harmful to water quality or human health.

Together, EPA, the states and the District are developing an approach for addressing permits that are consistent with the overall cooperative process.

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Frequently Asked Questions About Restoring Chesapeake Bay Water Quality

On June 28, 2000, the Chesapeake Executive Council signed *Chesapeake 2000* – a new and far-reaching agreement that now guides Maryland, Pennsylvania, Virginia, the District of Columbia, the Chesapeake Bay Commission and the U.S. Environmental Protection Agency in their combined efforts to restore and protect the Chesapeake Bay.

As part of that agreement, Bay Program partners agreed to work with the headwater states of Delaware, New York and West Virginia to set new, aggressive nutrient and sediment reduction goals that will provide the water quality necessary for the Bay's plants and animals to thrive.

This process builds on previous nutrient reduction goals, but instead of measuring improvement against broad percentage reduction goals, the Program must now meet goals based specifically on the needs of the Bay's plants and animals.

What makes this initiative so unique?

This cooperative effort has resulted in nutrient reduction goals that are much more protective than those agreed to in the past. Bay Program partners have agreed to base their success on the attainment of water quality standards, not simply pollution load reductions. For the first time, partners have developed criteria that take into account the varying needs of different plants and animals and the various conditions found throughout the Bay. For example, to drive new, aggressive sediment reductions, Bay Program partners also agreed to increase bay grass restoration goals from 114,000 to 185,000 acres baywide. All of these accomplishments were made due to cooperative efforts among the partners and stakeholders from throughout the Bay watershed and for the first time ever, the headwater states of Delaware, New York and West Virginia have been involved in these negotiations.

How much will it cost to bring back Chesapeake Bay?

Since the signing of the *Chesapeake 2000* agreement, several Bay organizations have explored possible funding sources for the restoration of the Bay.

Released in late 2002, the Chesapeake Bay Commission's "Cost of a Clean Bay" report estimates that approximately $18.7 billion is needed to meet commitments set forth in *Chesapeake 2000*. The report estimates it will cost $11.5 billion to achieve the water quality improvements necessary to bring back the Bay's aquatic plants and animals to levels seen in the 1950s. Most recently, the Commission has led an effort to develop a strategy that aims to obtain funds from a variety of sources including federal, state, local and private sources.

What kind of economic benefit will result from restoring the Chesapeake Bay?

In 1989, the value of the Bay was estimated at $678 billion. Since Bay restoration efforts will provide positive economic benefits for the regional economy, economists believe the Bay's value will increase. For example, cleaner, less polluted water may add more commercial fisheries and eco-tourism dollars to Bay state economies. Likewise, expanded underwater grass beds and improved dissolved oxygen levels may improve regional revenues by enhancing hunting, fishing and other recreational opportunities. Property values in certain areas may also increase as problem waterbodies are restored.

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How did you conclude that your nutrient reduction goals will be protective of living resources?

The new nutrient reduction goals are the result of nearly three years of work by researchers from federal and state governments, universities and conservation organizations from across the Chesapeake Bay watershed. The best science available tells us that meeting the new nutrient reduction goals will provide the water quality necessary to protect living resources. Bay scientists confirmed this through a series of computer model runs that simulate future water quality conditions resulting from possible management practices implemented throughout the watershed. Science drove the development of these criteria, not political or financial limitations.

How were costs considered in setting new Bay restoration goals?

While the economy changes over time, the need to protect the future of the Bay does not. We need to develop plans today that lay the groundwork for future restoration efforts. We cannot base plans that will take place over the next decade solely on today's economic conditions.

Financial limitations were not taken into account when the first Bay nutrient reduction goal was set in 1987, yet with the needs understood, resources became available and technological improvements enabled Bay Program partners to make significant strides in our nutrient reduction efforts.

Additionally, over the next decade we expect improvements in current pollution reduction technologies and the development of new technologies to offset some of the estimated costs of restoring the Bay.

How will technology benefit Chesapeake Bay restoration?

When coordinated Bay restoration efforts began in the 1980s, no one imagined the positive impact improved technology would have on the Bay. What many considered unattainable then, has become the standard today. Today's wastewater treatment plants, for example, have the ability to remove two to three times as much nitrogen as we thought would ever be possible in 1987. While we can't count on technology to be the sole savior of the Bay, we can count on bold nutrient reduction goals to help drive tomorrow's technological improvements. New technologies will continue to develop over time and allow us to better meet our future goals.

How does the new nutrient reduction goal differ from the original 40% goal set in 1987?

The reductions are now based on a better understanding of the needs of the Bay's living resources

being called for now are much greater than the original reductions called for when the partners agreed to a 40% reduction in nutrient loads to the Bay between 1985 and 2000.

Between 1985 and 2000, total annual nitrogen loads delivered to the Bay have been reduced by 53 million pounds. The new goal will require Bay Program partners to reduce nutrient loads by an additional 110 million pounds per year by 2010.

Why are current water quality criteria changing?

Previously, water quality criteria for dissolved oxygen were based on the assumption that all areas in the Bay were identical and did not take into account the natural variability found in the Bay's waters. Because conditions throughout the Bay differ based on depth, salinity and season, uniform baywide criteria do not take into account the varying needs of different plants and animals.

As a result, the water quality criteria have been revised to account for the natural variability in conditions found throughout the Bay. The Bay criteria differ from one region of the Bay to another, as determined by the plants and animals residing in that area. Future state water quality standards will need to be revised to incorporate the new water quality criteria.

How does changing water quality standards improve Chesapeake Bay water quality?

This effort is about adopting an innovative approach that will lead to new water quality standards tailored to the specific needs of plants and animals in all of the Bay's different habitats.

To be more protective in areas most critical to migratory fish, such as striped bass or rockfish, new standards will incorporate dissolved oxygen criteria that are higher than those currently in state standard. Science shows that rockfish, during the spring spawning season, need higher levels of oxygen than the current 5 mg/l. The new standards will reflect those needs and call for 6 mg/l during the spring season in areas critical to spawning rockfish.

In the Bay's deeper habitats, the new water quality criteria for oxygen are lower than those currently on the books, but higher than existing water quality conditions. The new criteria will remain protective of the species that reside in those areas, and new water quality standards - which better reflect natural conditions - offer a science-based approach to better target nutrient reduction decisions.

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Will bay grasses improve as a result of the changes in water quality criteria?

The resurgence of bay grass habitat is critical to the future health of Chesapeake Bay. Water quality restoration goals are being specifically tailored to the needs of underwater bay grasses. Currently about 85,000 acres of Bay bottom are covered by underwater grasses. Under this new process, Bay Program partners aim to expand that to 185,000 acres.

In addition to revising the water quality criteria for dissolved oxygen, the Bay Program has developed new criteria for water clarity. The states will be applying these new criteria to develop standards that will be protective of underwater bay grasses in shallow water habitats.

In order to improve water clarity for bay grasses, additional reductions in nutrient and sediment pollution are needed. For the first time, Bay Program partners have set a baywide goal for reducing the amount of sediment flowing into the Bay and its rivers. Large-scale sediment reductions, when combined with the new nutrient reduction allocations, will accelerate the resurgence of underwater bay grasses, as well as improve the quality of local streams and rivers.

Sediment goals have been set for upland areas and will be supplemented by additional reductions from shoreline areas. Shoreline sediment reduction goals will be developed as part of each state's local tributary strategy process and will increase the resurgence of local underwater grass beds.

How long does it take for the Bay to respond once management practices are put in place?

Some types of management practices will result in rapid improvements in Bay water quality while others may take years or even decades to have an effect. When nutrient reduction technology becomes operational at a water treatment facility, there are immediate reductions in the nutrient pollution loads that affect Bay water quality. On the other hand, most land-based management practices do not result in immediate reductions of nutrient and sediment pollution loads to the Bay. For some practices, noticeable improvement may be seen within a few years, for others, it may take a decade or more.

Improvements in Bay water quality also depend on the location of the management practices. Reductions from management practices in the upper reaches of the watershed will take longer to have an impact than those that occur closer to the Bay's waters. The Bay is a complex ecosystem that must be allowed time to respond.

Will these new goals remove the Bay from the list of impaired waters?

Based on current science, the nutrient reduction goals are expected to result in achieving the new dissolved oxygen criteria in all portions of the Bay except for one – a portion of the deep water between Kent Island and the Patuxent River – which encompasses only about four percent of the Bay's volume. In this area oxygen levels may occasionally exceed the criteria in deep waters during the summer. If this occurs, or if any portion of the Bay does not meet water quality standards in 2010, then a TMDL will need to be developed for that part of the Bay by 2011.

Since the states will have already developed localized tributary strategies to reduce nutrient and sediment loads, a great deal of progress toward achieving a TMDL will have been made. However, additional work may involve modifications to the strategies.

Since EPA is only publishing guidance, how can the public be assured that the states will follow it?

It is very important that the public be involved in the development of state water quality standards. The states will be soliciting public comment. It is important that the public becomes familiar with the EPA guidance so they can be sure that it is being followed. Additionally, in 2005 EPA will be reviewing the proposed standards and will decide whether or not to approve them.

Has this process involved the citizens of the Bay region?

Yes. We received hundreds of comments during the public reviews of the water quality criteria. Many more opportunities for public review and involvement will occur during the upcoming years as the states develop water quality standards and tributary strategies to achieve nutrient and sediment reduction goals.

How does this Baywide goal affect my local river?

In addition to the baywide pollution reduction goals, river – or tributary – specific reduction goals have been set in order to meet water quality standards in localized areas throughout the Bay. Tributary strategies will be developed that will be tailored to meeting the specific pollution reductions needed to attain water quality standards in specific locations throughout the entire Bay.

Achieving these basinwide reduction goals will result in improved water quality for the thousands of rivers and streams that eventually flow into the Bay.

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***Chesapeake 2000* contains more than one hundred commitments that will lead Bay restoration efforts in the decades to come. Sound science and sensible public policy are the backbone of the agreement, financial limitations are not.**

Since its signing, Bay Program partners have been working together to find the financial resources needed to meet *Chesapeake 2000's* goals to protect and restore the Bay for future generations.

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Restoring and Protecting the Chesapeake – How Much Will It Cost?

The Chesapeake Bay Commission's "Cost of a Clean Bay" Report

The Chesapeake Bay Commission, a tri-state legislative body with representatives from Maryland, Pennsylvania and Virginia, recently completed a fiscal analysis of the more than 100 commitments in *Chesapeake 2000*, the most recent Bay restoration agreement.

The analysis, "The Cost of a Clean Bay: Assessing Funding Needs Throughout the Watershed," estimates that it will cost approximately $18.7 billion to meet Bay protection and restoration goals between 2003 to 2010. According to the report, approximately $5.9 billion is projected to be available through current funding mechanisms, leaving about a $12.8 billion funding gap – or $1.6 billion per year – through 2010.

Estimating the "Value" of the Chesapeake Bay

In 1989, the value of the Bay was estimated at $678 billion. Since Bay restoration efforts will provide positive economic benefits for the regional economy, economists believe the Bay's value will increase. For example, cleaner, less polluted water may add more commercial fisheries and eco-tourism dollars to Bay state economies. Likewise, expanded underwater grass beds and improved dissolved oxygen levels may improve regional revenues by enhancing hunting, fishing and other recreational opportunities. Property values in certain areas may also increase as problem waterbodies are restored.

The Cost of Improving Water Quality

The Commission's report provides a big-picture look at costs associated with restoring the Bay. Of the total $18.7 billion price tag, approximately 60% – or $10.8 billion – is attributed to achieving the nutrient and sediment reduction goals set forth in *Chesapeake 2000*. Reaching these goals will provide the water quality necessary for the Bay's plants and animals to thrive, and ultimately remove the Chesapeake Bay from the federal list of impaired waters.

The reported costs for meeting the nutrient and sediment goals include estimates for pollution reductions from agricultural lands, septic systems, new and retrofitted storm water measures as well as upgrades to wastewater treatment plants. The analysis also shows that point source controls, such as upgrades to wastewater treatment plants, on average are one-half the cost of nonpoint source controls throughout the watershed.

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What's Included in the Commission's Estimate

The Commission's cost estimate includes funds spent on Bay-related projects in the states of Maryland, Pennsylvania and Virginia, which comprise the Commission's membership. Delaware, New York, West Virginia and the District of Columbia were not included in the analysis.

Additionally, only a portion of federal funding spent on Bay-related efforts was included. The report incorporates only federal funding given directly to states and does not include those used directly by federal agencies for Bay restoration or awarded to local governments and nonprofit organizations.

The Chesapeake Bay Program's Federal Agencies Committee, which includes representatives from all federal agencies involved in Bay-related issues, is currently in the process of quantifying the amount of funding directly spent by federal agencies on Bay restoration projects.

Understanding the costs associated with the current Bay agreement allows restoration leaders to target funds to maximize environmental benefits. For example, the analysis shows that preventing pollution from reaching the Bay's waters is less expensive than removing it.

The figures included in the report were developed by the Bay Commission in cooperation with the three states. Although each state manages its programs differently, a basic set of assumptions was developed to insure that the final analytical assumptions were comparable. Cost estimates were identified based on historical knowledge of funding sources available in previous years, while projections were based on the states' assumptions concerning the necessary actions required to meet each *Chesapeake 2000* commitment.

Projected *Chesapeake 2000* Costs and Income by State

(in billions of dollars)

Chesapeake 2000 Goals	Maryland	Pennsylvania	Virginia	Total
Living Resources				
Cost	0.1	1.2	0.1	1.4
Income	0.1	0.1	0.1	0.2
Vital Habitat				
Cost	0.4	0.5	0.1	1.0
Income	0.2	0.2	0.1	0.5
Water Quality				
Cost	3.9	3.1	4.5	11.5
Income	1.7	0.2	0.2	2.1
Land Use				
Cost	1.5	1.4	1.3	4.2
Income	1.5	0.9	0.7	3.1
Community Engagement				
Cost	0.5	0.1	0.1	0.7
Income	0.1	0.1	0.1	0.1
Total				
Cost	6.4	6.2	6.1	18.7
Income	3.5	1.4	1.0	5.9
Funding Gap	2.9	4.8	5.1	12.8

source: Chesapeake Bay Commission

For more information or to order a copy of the Commission's report, "The Cost of a Clean Bay: Assessing Funding Needs Throughout the Watershed," visit the Commission's website at www.chesbay.state.va.us.

For additional information about restoring Chesapeake Bay water quality, visit www.chesapeakebay.net.

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Chesapeake Bay Program
A Watershed Partnership

Backgrounder

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The Bay Program is moving toward a fish-eye view of the Chesapeake. What a fish sees, though, is a highly diverse Chesapeake Bay. There are shallow areas that are important for spawning, and grass beds that serve as nursery areas for their young. There are also large areas of open water where they feed on algae or other fish. Deep areas, where they may rarely venture during the summer, are important refuges from winter cold.

The new criteria and designated uses seek to take that diversity into account by essentially zoning the Bay. They divide the Bay and its tidal tributaries into five "designated uses" based on the types of habitat provided for specific species: shallow-water bay grass, open-water fish and shellfish, spawning and nursery areas, deep-water seasonal fish and shellfish, and deep-channel seasonal refuge. Different criteria would be applied to each use based on the species found there: grasses in shallow water, adult fish in open water, oysters in deep water, crab food in the deep channel, and so on.

Defining Designated Uses - or Habitat Zones - for Bay Water Quality Restoration

Migratory Fish Spawning & Nursery Use Habitat

Designated Use: Protects migratory and resident tidal freshwater fish during the late winter to late spring spawning and nursery season in tidal freshwater to low-salinity habitats.

Boundary: From the upper extent of tidal waters to the lower reach of existing spawning and nursery habitats, and from the water surface to the bottom or to the pycnocline where it exists.

Representative Species/Life Stages: Adult spawning, egg, larval and juvenile life stages of striped bass, American shad, hickory shad, alewife, blueback herring, white perch and yellow perch and other migratory species not listed here.

Critical Support (food, shelter) Communities: Phytoplankton, zooplankton, underwater grasses, forage fish and bottom-dwelling worms and clams.

Seasonal Use Application: The migratory spawning and nursery designated use applies from February through May; during the rest of the year, the open water designated use applies.

Applicable Bay Water Quality Criteria: Dissolved oxygen.

Shallow Water-Bay Grass Use Habitat

Designated Use: Promote the growth of balanced, native populations of ecologically, recreationally and commercially important fish, shellfish and underwater grasses.

Boundary: Tidal waters up to two meters in depth where SAV has been historically observed, measured from low tide

Representative Species/Communities: Largemouth bass, pickerel, juvenile speckled sea trout, blue crabs and underwater grasses.

Critical Support Communities: Phytoplankton, zooplankton, forage fish and bottom-dwelling worms and clams.

Seasonal Use Application: The shallow-water designated us applies from April through October; during the rest of the year the open-water designated use applies.

Applicable Bay Water Quality Criteria: Water clarity.

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Open-Water Fish and Shellfish Use Habitat

Designated Use: Promote the growth of balanced, indigenous populations of ecologically, recreationally and commercially important fish and shellfish species.

Boundary: Tidal waters extending vertically from a 2-meter depth into the water column to the bottom, or to the top of pycnocline in areas where it exists and prevents mixing with the surface waters.

Representative Species: Menhaden, bay anchovy and striped bass.

Critical Support Communities: Phytoplankton, zooplankton and forage fish.

Applicable Bay Water Quality Criteria: Dissolved oxygen and chlorophyll *a.*

Deep-Water Seasonal Fish and Shellfish Use Habitat

Designated Use: Protect the propagation and growth of balanced, indigenous populations of ecologically, recreationally and commercially important fish and shellfish species.

Boundary: Tidal waters below the depth of the pycnocline or, in the absence of a measured pycnocline, below a certain depth that would vary in different parts of the Bay based on geographic conditions.

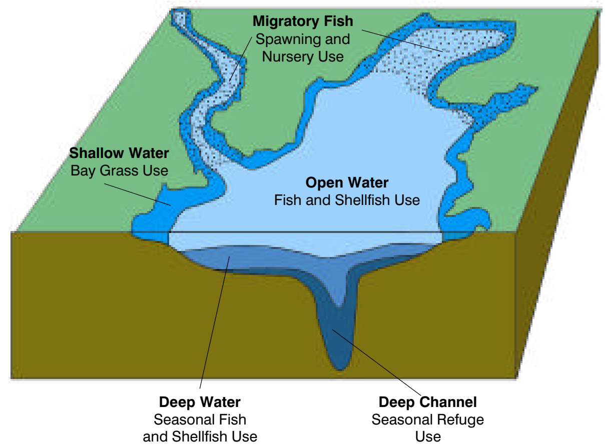
Representative Species: Blue crab, oyster, softshell clam, hard clam, spot, croaker, flounder and catfish.

Critical Support Communities: Bottom-dwelling worms and clams, and reef-inhabiting forage fish.

Seasonal Use Application: The deep-water designated use applies from June through September, during the rest of the year the open-water designated use applies.

Applicable Bay Water Quality Criteria: Dissolved oxygen.

Oblique View of the Chesapeake Bay and Its Tidal Tributaries



Deep-Channel Seasonal Refuge Use Habitat

Designated Use: Refuge for balanced, indigenous populations of ecologically, recreationally and commercially important fish species that depend on deep channel habitats for overwintering during the months of October through May; and for the propagation and growth of bottom sediment dwelling worms and clams that provide food for bottom-feeding fish and crabs during the months of June through September.

Boundary: Very deep water column and adjacent bottom surficial sediment habitats located principally in the channels at the lower reaches of major tidal rivers and along the spine of the upper and middle mainstem Bay.

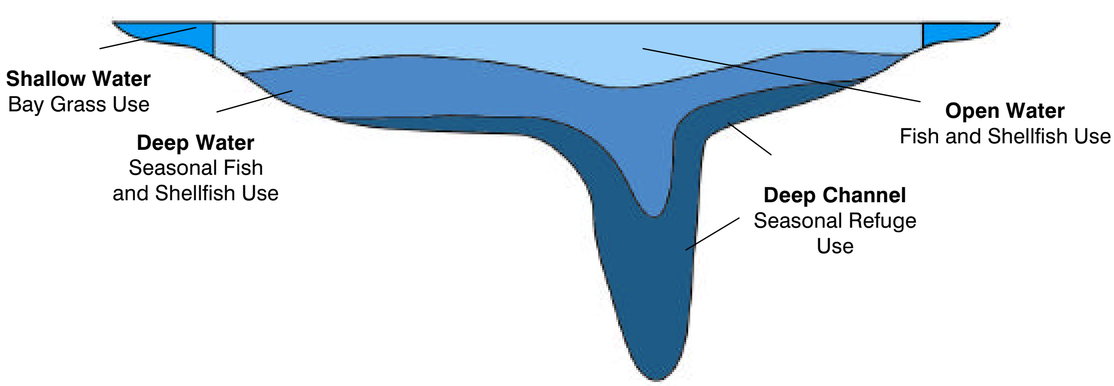
Representative Species: Blue crab, migrating striped bass, white perch, Atlantic croaker, shortnose sturgeon and Atlantic sturgeon.

Seasonal Use Application: The deep-channel designated use applies from June through September; during the rest of the year the open-water designated use applies.

Critical Support Communities: Bottom-dwelling worms and clams.

Applicable Bay Water Quality Criteria: Dissolved oxygen.

Cross Section View of Chesapeake Bay or Tidal Tributary



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Chesapeake Bay Program
A Watershed Partnership

Backgrounder

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Like their terrestrial counterparts, all aquatic life — from worms burrowing in the Bay's bottom to striped bass swimming along the surface — needs oxygen to survive. The amount of oxygen needed varies with time of year and species. Oxygen needs vary even with the life stage of a species; young species tend to be more sensitive to low oxygen conditions than adults. Also important is the duration of periods with low oxygen. Most species can survive short periods of reduced oxygen, but suffer during longer periods.

New Chesapeake Bay Water Quality Criteria: Dissolved Oxygen

Migratory Fish Spawning & Nursery Use

6 mg/l averaged over 7 days with a 5 mg/l 1-day minimum from February through May.

From June through January, the shallow-water/open-water use criteria apply. This is intended to protect larval and early juvenile stages of freshwater species in upper tributaries and the Upper Chesapeake Bay. The early life stages are often more sensitive to low oxygen levels than adult fish

Shallow-Water Bay Grass and Open-Water Fish and Shellfish Uses

5 mg/l as a 30-day average in tidal habitats with greater than 0.5 parts per thousand salinity or 5.5 mg/l as a 30-day average in tidal habitats with 0-0.5 parts per thousand salinity, with a 7-day average of 4 mg/l and an instantaneous minimum of 3.2 mg/l

This provides enough oxygen for the survival of larval and juvenile fish found in these areas. The minimum level is enough to prevent lethal effects for the Atlantic and shortnose sturgeon, the latter of which is listed as an endangered species.

Deep-Water Seasonal Fish and Shellfish Use

3 mg/l as a 30-day average, with a 1-day mean of 2.3 mg/l and an instantaneous minimum of 1.7 mg/l from June through September. From October through May, the shallow-water and open-water use criteria apply.

During the summer, these oxygen levels would protect eggs and larvae of bay anchovy, one of the most abundant fish in the Chesapeake and a critical link in the food chain, as well as crabs, oysters and bottom feeding fish like spot and flounder.

Deep-Channel Seasonal Refuge Use

An instantaneous minimum of 1 mg/l from June through September. From October through May, the shallow-water/open-water use criteria would apply.

These levels are intended to protect worms, clams and other bottom dwellers that can tolerate low oxygen levels during the summer and provide food for crabs and bottom feeding fish. In winter, these same areas are important foraging areas for blue crabs and finfish (striped bass, white perch, sturgeon) that seek refuge in these deeper, warmer waters.

The Chesapeake Bay Program is restoring the Bay through a partnership among the U.S. Environmental Protection Agency representing the federal government, the State of Maryland, the Commonwealth of Pennsylvania, the Commonwealth of Virginia, the District of Columbia, the Chesapeake Bay Commission, and participating citizen advisory groups.

4/2003

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Backgrounder

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Over the next several years, Maryland, Virginia, Pennsylvania, New York, Delaware, West Virginia, and the District of Columbia will continue their joint effort to improve water quality for the plants and animals living in the Chesapeake Bay and its tributaries.

Working with the U.S. Environmental Protection Agency, this seven-jurisdiction cooperative partnership will continue to work together to improve water quality through an innovative process that uses three simple, yet encompassing, criteria to monitor the health of the Bay's complex ecosystem and living resources — dissolved oxygen, chlorophyll *a* and water clarity.

New Chesapeake Bay Water Quality Criteria: Chlorophyll *a* and Water Clarity

Chlorophyll *a*

Chlorophyll is the pigment that allows plants (including algae) to convert sunlight into organic compounds (photosynthesis). Of the several kinds of chlorophyll, chlorophyll a is the predominant type of algae.

Measuring chlorophyll *a* concentrations in water is a surrogate for an actual measurement of algae biomass, which is far more expensive and time consuming. Excessive amounts of chlorophyll a indicate the presence of blooms. Blooms usually consist of a single species of algae, typically one that is not desirable for consumption by fish and other predators. Unconsumed algae sink to the bottom and decay, a process that depletes deeper water of oxygen.

On the other hand, too little chlorophyll *a* would mean that not enough “fish food” is available to fuel the food web.

The narrative criteria describes the various possible impacts on tidal Bay habitats due to too much algae and the wrong types of algae. Supporting target concentrations will be used by the state to establish numerical chlorophyll *a* criteria to address localized algal-related problems.

Water Clarity

Underwater bay grasses, commonly referred to as submerged aquatic vegetation (SAV), needs sunlight to survive, albeit less than its terrestrial counterparts.
The criteria would apply to depths up to two meters. Areas where SAV never occurred or where natural factors, such as currents and wave action, prevent its growth would be excluded.

In low salinity water, 13% of the light that hits the water surface must reach the underwater plants on the bottom. In high salinity water, 22% of the light that hits the water surface must reach the underwater plants on the bottom.

Chesapeake Bay Program
1983-2003
20 Years
Bringing Back the Bay

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Over the past three years, researchers, scientists and policymakers from six states, the District of Columbia and the federal government, have worked together to develop new science-based goals that will allow the Bay states and the District to implement plans to reduce nutrient and sediment pollution entering the Bay through local streams and rivers.

This list contains some of the key milestones that Bay Program partners project meeting as we continue our work to protect and restore the Chesapeake for future generations.

Next Steps for Bay Water Quality Restoration

April 2003 Bay watershed jurisdictions – Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia and the District of Columbia – will begin the development of tributary strategies to achieve pollutant load reductions.

July 2003 Jurisdictions with tidal waters – Delaware, Maryland, Virginia and District of Columbia – will propose new or revised water quality standards.

April 2004 Jurisdictions will complete development and begin implementation of new Tributary Strategies.

2005 Jurisdictions with tidal waters will finalize adoption of new or revised water quality standards.

2005 Pollutant load allocations for each jurisdiction within the nine major basins will be finalized.

2005 State-defined Tributary Strategies will be finalized with minor revisions to reflect new water quality standards.

2010 The *Chesapeake 2000* agreement calls for Bay Program partners to have corrected the nutrient and sediment-related problems in the Chesapeake Bay and its tidal tributaries sufficiently to remove the Bay and the tidal portions of its tributaries from the list of impaired waters under the Clean Water Act.

2011 Bay Program partners will begin development of TMDLs for any areas of the Bay that may still be listed for impairments due to nutrient and sediment related problems.

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This list contains a few of the common terms found throughout their work.

CHESAPEAKE BAY PROGRAM
1983–2003
20 Years
Bringing Back the Bay

Glossary of Water Quality Terms

Bathymetry – The physical characteristics, including depth, contour, and shape of the bottom of a body of water.

Benthic macroinvertebrates – Macroinvertebrates are large, generally soft-bodied organisms that lack backbones. Benthic macroinvertebrates live in or on the bottom sediment in aquatic environments.

Cap load – Cap loads are the maximum pollutant load of nutrients and sediments that can be allowed and still meet Chesapeake Bay water quality criteria.

Cap load allocations – Based on each tributary's nutrient and sediment input to the Bay, the total Chesapeake Bay load is apportioned to each tributary and jurisdiction. The cap load allocations show where the nutrient and sediment loads will most effectively be reduced to achieve the restoration goal.

Chlorophyll *a* – A pigment contained in plants that is used to turn light energy into food. Chlorophyll also gives plants their green color.

Designated use – An element of a water quality standard, expressed as a narrative statement, describing an appropriate intended human and/or aquatic life objective for a water body. Designated uses for a water body may include: recreation, shellfishing, water supply and/or aquatic life habitat.

Diatoms – Microscopic algae with plate like structures composed of silica. Diatoms are considered a good food source for zooplankton.

Dissolved Inorganic Nitrogen (DIN) – An important nutrient for the growth of plants. DIN is nitrogen that is readily usable by plants.

Epiphytic – Substances that grow or accumulate on the leaves of submerged aquatic plants. This material can include algae, bacteria, detritus, and sediment.

Eutrophic – Describes an aquatic system with high nutrient concentrations. These nutrient concentrations fuel algal growth. This algae eventually dies and decomposes, which reduces the amount of dissolved oxygen in the water.

Impaired waters list (or impairments) – Impaired waters are waters that do not meet State water quality standards. Under the Clean Water Act, section 303(d), States, territories and authorized tribes are required to develop lists of impaired waters. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop TMDLs for these waters.

Light attenuation – Absorption, scattering, or reflection of light by water, chlorophyll a, dissolved substances, or particulate matter. Light attenuation reduces the amount of light available to submerged aquatic vegetation.

Mesotrophic – Describes an aquatic system somewhere between eutrophic (nutrient enriched) and oligotrophic (nutrient poor).

Phytoplankton – Plankton are usually very small organisms that cannot move independently of water currents. Phytoplankton are any plankton that are capable of making food via photosynthesis.

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